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Editorial

Cotton and Sugarcane: The out put of raw cotton is to be increased by five laks of bales. This was the decision arrived at the conference of provincial agricultural ministers recently held in Bombay. Preference is to be given to long staple cotton, which has hitherto been largely imported from countries outside India. The cotton industry is now facing a crisis. The inadequate supply of raw cotton has resulted in keeping many mills idle and throwing the industry out of gear. Though the food problem is by far the most important facing the country, the question of feeding our industries cannot be neglected without serious detriment to the national economy. It was the appreciation of this fact, we believe, that has led the conference to arrive at the decision of increasing the out put of cotton in the country. How far the increase in cotton production will interfere with the Grow More Food Campaign it is difficult to surmise. But it has been pointed out that it is not necessary to encroch on the area meant for food crops but cotton could be profitably grown as a mixed crop with groundnut without serious detriment to the latter. Moreover, savings in foreign exchange resources effected by non-purchase of cotton from outside will to some extent off set the price we have to pay for import of food from abroad There is reason to believe that surplus wheat production which has been reported from America, Australia and parts of Europe may result in lowering the prices of cereals in the world market. The net gain in our national economy will therefore be on the whole beneficial to the country if it is made less dependent on foreign countries for its cotton and other raw materials for its industry. With regard to sugar the reason for shortage is not clear The Sugar Committee which may be presumed to have full knowledge of the facts concerning the industry are of the opinion that the present scarcity is artificially created. If it were so, it is up to the people responsible to rise above their private interests and remedy the existing state of affairs

The appeal of Sardar Patel to the industry appears to have had some effect and we hope that before the present season is over the supply of sugar would be sufficient to meet the needs of the country.

The Prime Minister and Deputy Prime Minister: India is fortunate in having two such men as Pandit Nehru and Sardar Patel at the helm of its affairs at the present juncture. During these two years of stress and strain they have proved themselves to be supermen and though bereft of the guiding hand of their master they have faced the tasks set before them with undaunted courage and outstanding ability. The country is grateful to them and the Madras Agricultural Journal joins in rendering its respectful homage to them and wishes them all success in their great endeavour of making India a great nation.

Cyclone havoc in Andhra Desa: The Cyclone havoc in the Andhra Districts has now been roughly estimated and large tracts of valuable paddy lands have at least temporarily been laid waste and a large number of harvested and standing crop lost; cattle have been washed away. To rebuild this area an appeal for funds has been sent out. We add our appeal to our readers, to donate liberally for the cause of this relief

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NOTICE TO SUBSCRIBERS.

The cost of printing and paper is still high. We appeal to such of our members as are in arrears and other members to kindly remit their subscriptions early.

Studies in preparation, preservation and renovation of butter and ghee

By

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Ghee is the most convenient form in which milk fat could be preserved for human consumption, especially under tropical and sub-tropical conditions. The importance of ghee in our dietary is well known and need not be emphasized here. Unfortunately, ghee that is made available in the markets to the bulk of the population is deplorably poor in quality, with an unpleasant smell and is often adulterated. Adulteration is intentional, the motive being excessive profiteering. Other reasons for the bad quality are entire indifference and ignorance to an extent on the part of producers in preparing and preserving the product. Good ghee can be easily made and at no greater cost than bad or indifferent ghee.

The factors responsible for the spoilage of ghee have been found by the various workers to be the following :

(1) Unsuitable and improperly cleaned vessels used for handling milk, curds, butter and ghee. (2) Defective boiling of milk for conversion into curds. (3) Bad quality starters and defective ripening. (4) Accumulation of butter for a number of days to get sufficient quantity for conversion into ghee. (5) Improper washing of butter, that is, free of the adhering and heldup curd particles. (6) Defective storage of ghee, exposed to air and light which hasten the spoilage of the product and (7) Contact with porous earthenware and metals like copper, brass and iron without proper tinning, which increase the spoilage.

The defects pointed out in ghee making and storage are controllable, and good ghee could be produced, which would keep well for reasonably long periods. Studies were made with the object of evolving suitable methods of making butter and ghee with low initial acidity and methods of renovating bad butter and ghee, that are normally available in the market. The study was confined to practical methods that could be easily adopted in an ordinary household without any additional out-lay or equipment.

For all these trials buffaloes milk produced in the College Dairy was boiled and converted into curds. Butter was made from curds by the local method using the churning rod. All attempts were made to maintain uniform quality in curds, butter and ghee throughout the trials.

I. **Quality of butter:** *Washed Vs., Unwashed butter*: Butter was made from curds by the ordinary local method. The butter that floated on the butter-milk after churning was gathered. One third of this quantity was bulked and pressed with scotch hands on a butter board to remove as much of the butter-milk as possible. This was taken as unwashed sample. The remaining two thirds was transferred to a vessel of water and gently agitated for a few minutes to wash the butter granules. Half of this quantity was taken as the once washed sample, and was well pressed to remove as much wash water as possible. The remaining third was gathered, drained and transferred to another vessel of water for giving a second washing. The butter grains were agitated for a few minutes and pressed. This was taken as the twice washed sample. The acidity of the three samples of butter were determined by the Nissen's method and expressed as lactic acid. The same method of testing acidity was followed throughout the trials. The three fresh lots were converted into ghee. The ghee was filtered to remove the sediment and the samples were tested for acidity. The results of the analysis are furnished below:

	Perceneage acidity: Butter	Ghee
Unwashed	0·0871	0·0526
Once washed	0·0615	0·0379
Twice washed	0·0571	0·0320

The above results indicate that washing the butter reduces the acidity of butter and the resulting ghee. Hence washing the butter grains free of the adhering curd particles and butter-milk helps to give ghee with a lower initial acidity. Acidity is one of the factors promoting rancidity in ghee and reducing its storage life. The low acid ghee can be preserved without much of deterioration over a longer period than ghee with high acidity.

II. **Preservation of butter:** Fresh butter from most houses is of fair quality. The butter produced every day is small and it is accumulated till a sufficient quantity becomes available for melting into ghee. But the butter deteriorates during storage and develops a sour smell, due to the increase in the acidity of the enclosed butter-milk. Putrid odour of varying degrees develops due to changes in the proteinaceous curd particles held up by the butter. Moulds also develop on the surface of butter occasionally and such samples are devoid of the characteristic butter flavour. The deterioration that sets in butter during storage is marked and in most cases accounts for the bad quality of the resulting ghee.

The following methods of storing butter were studied with a view to find out the best method suitable for the ordinary household: (1) Dry preservation — by keeping the lump of butter in a vessal, without

any treatment. (2) Preservation under brine — by pressing the butter firmly to the bottom of a vessel and keeping it submerged in saturated common salt solution. (3) Preservation under water — by pressing the butter firmly to the bottom of a vessal and keeping it submerged in water. (4) Preservation under butter milk — by pressing the butter firmly to to the bottom of a vessal and keeping it submerged in butter-milk.

Water and butter-milk used for submerging the butter were changed every day. In all cases small aluminium vessals of the same size and shape were used and covered with lids and kept inside a cup-board. Samples of butter were drawn on the 4th, 8th and 12th day and converted into ghee. The acidity of the butter and ghee samples were as follows;

Days of storage of Butter.	% Acidity as lactic acid.			
	Methods of storage			
	Dry.	Under Brine.	Under Water.	Under Butter-milk.
		Butter.		
0	0·0775	...	...	...
4	0·1086	0·1251	0·0950	0·0937
8	0·1551	0·1413	0·1061	0·0937
12	0·1636	0·1885	0·1619	0·1830
		Ghee.		
0	0·0506	...	...	...
4	0·0657	0·0706	0·0613	0·0547
8	0·0780	0·0750	0·0715	0·0694
12	0·0850	0·0756	0·0739	0·0897

The following observations were made during the storage of butter and the making of ghee:

A. BUTTER: (i) *Dry preservation*: Butter got dried up on the surface by losing moisture. The dry appearance got more pronounced with increase in the storage period. From the 8th day onwards there was change in colour and decrease in flavour. On the 12th day the butter was badly mouldy, and off-flavour was very marked. (ii) *Brine preservation*: There was no change in colour. From the 8th., day onwards there was loss in flavour and on the 12th., day off-flavour was marked. But the quality was much better than the dry preserved sample. (iii) *Water preserved*: The changes were exactly the same as in the case of brine preserved butter. (iv) *Butter-milk preserved*: There was no change in colour right through. The flavour was also maintained even till the 12th., day. The butter looked fresh with the characteristic butter-milk flavour. This was the best of the lots, and good enough for consumption as butter.

B. GHEE: (i) *Dry preserved butter*: Due to the dryness of butter, it took minimum time for conversion into ghee. During boiling, pungent odour was emitted, and there was also spurting of the material. These two characteristics, viz. pungent odour and spurting, were not met with in the other samples. Quality of ghee was tolerable, but the true ghee flavour was not conspicuous. Ghee made from 12 days old butter had a marked off-flavour. (ii) *Water preserved butter*: The quality of ghee made with 4 days old butter was fairly good. Ghee from the samples, 8 and 12 days old respectively, were not so good, but were tolerable. (iii) *Brine preserved butter*: The quality was exactly the same as that of the samples under water (ii). (iv) *Butter-milk preserved butter*: All the samples of ghee were fairly good and free from any off-flavour. The quality was decidedly better than ghee from the other samples.

Thus, preservation of butter under butter-milk appears to be the best method. Preservation under water is next best. Preservation under brine is unnecessary and dry preservation is undesirable. In any case, butter should be melted in as fresh a state as possible, preferably every fourth day as being convenient.

III. **Renovation of butter**: Trials were made with the object of renovating and improving the quality of bad quality bazaar butter. A portion of the butter was directly converted into ghee (sample A). The rest of the butter was well washed under the tap by kneading till the wash water was clear. A portion of the washed butter was boiled into ghee (sample B). The remaining portion was boiled with thin slices of fully ripe banana fruits (without rind) at one ounce of slices per pound of butter (sample C). In all the cases the butter and ghee samples were tested for acidity with the following results.

	% Acidity as lactic acid	
	Butter.	*Ghee.*
A. Bazaar butter	0·1741	0·0820
B. Washed butter	0·1125	0·0536
C. Washed butter boiled with banana slices	0·1125	0·0295

The unwashed butter had an acid smell and bad odour. The washed butter had acid smell and the colour was much improved due to the removal of the adhering dirt. But the butter got pasty and soft during washing and there was improvement in the quality of the resulting ghee. The butter was boiled with banana slices, till the slices were brownish in colour and flaccid at the end. While the ghee was cooling, the slices turned dark, got firm and looked like charred banana chips. The ghee made with the original sample of bazaar butter was bad. Washing the butter improved the quality of the resulting ghee. When banana slices were added during boiling, the ghee produced was free of bad odour and of fair quality.

IV. **Renovation of ghee**: A sample of bad smelling rancid ghee was reboiled with banana slices at one ounce to the pound, till the slices turned brown. During cooling, the slices turned dark in colour. The ghee was filtered and tested for acidity, with the following results: Rancid ghee sample 0·1221 ; reboiled with banana slices 0·0380.

The original sample of ghee was unpleasant in smell and repulsive to the taste. The ghee after reboiling with banana slices was passable in in flavour and taste. This appears to be a suitable method of renovating rancid ghee.

Summary: 1. Washing butter grains free of the adhering and held-up butter-milk before bulking gives good quality butter and ghee. 2. When butter is stored for some days, it is advisable to keep it submerged in thin butter-milk and change it every day. 3. Bad butter can be improved by washing it throughly with clean and sweet water, kneading it well during washing, till the wash-water is clear. The ghee obtained from washed butter is nearly normal. By adding ripe banana slice at an ounce to each pound of old butter, during boiling, fairly good ghee could be produced. 4. Rancid ghee can be renovated by boiling it again with slices of fully ripe bananas at an ounce to a pound (roughly 1 fruit per pound) till the slices get browned. The recommendations made are simple, practicable, cheap and easily adaptable.

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Some economic spices of India

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It is a matter of gratification that our country is blessed with a number of useful spices like pepper, cardamom, clove, nutmeg, cinnamon, ginger and turmeric. An indication of the present position of spices in the country is presented below :

Names of spices.	*Acreage.*	*Annual crop production in lbs. ('000).*
Pepper	1,00,000	25,000
Cardamom	1,20,000	9.000
Ginger	12,000	9,600
Turmeric	50,000	1,50,000
Clove	200	200
Nutmeg	300	105
Cinnamon	400	1,000

By far the largest proportion of pepper production is from this country; cardamom, ginger and turmeric also have gained importance and rank high in the country's commerce. According to the available marketing reports, the annual export of spices to foreign countries is 1,51,000 cwts. of pepper, 10,500 cwts. of cardamom, 31,000 cwts. of ginger and 43,200 cwts. of turmeric. The position of clove, nutmeg and cinnamon however, remains very unsatisfactory. Although some of these spices are later introductions, the progress they have made over the last two and a half centuries and the position they have attained is far from satisfactory.

Distribution: The distribution of the spice-growing areas of this country can be indicated as: 1. The narrow belt of the low-lying country in the West Coast extending from Cape Comorin to the Ratnagiri Dt. in Bombay, which mainly grows cloves. 2. The humid hilly tracts of the Nilgiris, Lower Palnis and Tirunelveli are suited for a number of spice crops, particularly nutmeg, cardamom, clove and cinnamon. 3. The low-lying wet zones of Wynaad, Coorg, Mysore, Travancore, Cochin and Tirunelveli. The main commercial crop here is cardamom. 4. The wetter areas of Malabar, South Kanara, Coimbatore, Madura and Tirunelveli are known to cultivate ginger on a large scale. 5. The dry districts like Guntur, Cuddapah and parts of West and East Godavari, Salem and Coimbatore grow turmeric on a large scale.

Outside the limits of this province, cloves, cardamoms, turmeric and ginger are cultivated on a comparatively limited scale in Bombay, the Shan States, U. P., Bengal and the Punjab. It is estimated that out of about 2,87,000 acres covered by spices in the country over 2,46,000

acres are confined to the South Indian Provinces and States. It is therefore needless to over-emphasise the importance of spice production in this part of the country. Although the progress of the spice industry has been satisfactory in respect of a few spices, the progress made by other spices reveals that there is room for considerable improvement of the spice trade in this country.

Imports and exports: In pepper, cardamom, ginger and turmeric, India can claim an enviable position in the world market. She has not only been able to meet her own internal requirements but has also been able to maintain a consistent export trade for decades past. On an average, India exports annually about 1,50,000 cwts. of pepper, 30,000 cwts. of ginger, 43,000 cwts. of turmeric and 10,500 cwts. of cardamom, worth in all about two crores of rupees. At the same time, with cloves, nutmeg and cinnamon, India has been dependent on Ceylon, Burma and Java even for its bare domestic requirements. This contrasting picture, obviously, indicates that no sustained efforts have been made by the Indian planters and the State in respect of the latter crops. The probable causes for the slow progress made in this respect are examined below :

Handicaps and difficulties: Two and a half centuries have passed by since the introduction of cloves, nutmeg and cinnamon in this country but the area covered by these spices hardly exceeds 800 acres today. Coffee, which was introduced a century later now covers 65,000 acres of cultivated land in South India alone. Such a disparity between the first group of crops and the latter naturally means that the former have not appealed to the Indian planter on account of (1) the extra care and nursing that the crops require in the nursery (2) the abnormal pre-bearing period associated with these plants as a result of seed propagation, which often culminates in disappointment caused by a disproportionately large number of male nutmeg trees. (3) The unhealthy and malarial conditions of the regions to which these crops are best suited, (4) want of adequate transport and residential facilities to enable effective supervision and profitable marketing. It is not, therefore, a matter for surprise that pepper, ginger, turmeric and cardamom with their easier methods of vegetative propagation and more convenient areas of production have gained the favour and fancy of the planters. But this does not mean that the country should be allowed to remain perpetually dependent on foreign lands where also these spices are produced under similar conditions.

It is a fact that in most orchards, clove and nutmeg trees are given a secondary place and the extent of attention bestowed is nothing short of neglect. Even so, from the condition of the existing plantations of these spices, one can easily judge that the production of clove and nutmeg is comparatively easy. The fact that these spices still flourish, strewn and scattered under neglect, right from the West Coast upto the foot-hills

of the central districts, is not only a proof of their hardy nature, but also that they have got acclimatised large in areas of land suited for their culture. Further, the preliminary trials conducted at fruit centres in Araku Valley and Wynaad have indicated that these un-utilised regions are well suited for the cultivation of these spices. It is obvious, therefore, that space has not been a limiting factor for their progress; but if these areas had been properly managed the country's output would have been several fold of what it is now.

Suggestions to overcome handicaps: The difficulties therefore lie in other directions. Finding out easier and more reliable methods of propagation is one of the primary criteria. Preliminary propagational trials made at the Burliar Fruit Station have indicated the possibility of grafting cloves on its stock, and that of nutmeg on *Myristica beddomei* and the successful rooting of cinnamon shoots by layering. Germination trials conducted at the same station have also disclosed that the low germinations of nutmeg and clove seeds can be increased to 97 per cent and 60 per cent respectively. The unhealthiness of the tract no doubt presents a serious handicap, when the planter could bestow so much attention on coffee or tea under similar conditions, these spices should deserve at least an equal attention, considering the economic gains.

The high cost of transport is often mentioned as one of the stumbling blocks in the way of progress of these spice crops. Although one cannot entirely deny this, it cannot be gainsaid that the same factor is applicable to a number of other crops like fruits, and drugs which are grown under the same set of conditions, but it has not stood in the way of their progress. It would be seen from the data furnished below on the cost of production of a pound of clove, that transport by itself does not contribute so much towards swelling up the cost of production as the other items.

Approximate cost of producing of one pound of dry clove (in the 10th year of bearing) in a village near Burliar Fruit Station:

		Rs.	as.	ps
Cost of plant material	...	0	2	10
Cost of culture (inclusive of irrigation charges)	...	0	3	6
Charges on harvesting and transporting	...	0	0	7
Curing charges etc.	...	0	0	2
Total	...	0	7	1

It is no doubt to be admitted that the net cost is subject to variation depending upon the degree of accessibility or otherwise of the place where the spice is cultivated. Thus it is obvious that sustained efforts do not seem to have been made in the improvement of spices, on the imaginary fear of handicaps and hindrances. In order that the country may get the maximum benefits out of these crops a serious endeavour is called for on the part of Indian planters on the lines above indicated.

Conclusions: (1) The paper deals with the economic and commercial importance of some of the important spices of India. (2) A brief survey of the causes of the success and failure of the respective spice crops has been made. (3) The possible methods of crop culture which would go to set off the factors handicapping the progress of the spice industry have been indicated. (4) An appeal to the planter to make a serious endeavour to make good the deficiency in the spice crop production is made.

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Transmission of research on pest control

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Every cultivated plant or tree has its own specific insect enemies, and agricultural products, which, are grown and stored at so much expense and trouble, are also not exempt from the depredations of insects. It has been computed that over 200 species of insects occur as major pests and that the damage caused by them both in the field as well as the godown, deprives the ryot by about 10 to 15% of his legitimate earnings. It has also been estimated by various authorities that the overall food deficit for the entire country is from 7 to 15%. It would thus seem as if the entomologist by himself might be able to wipe out food deficit in the country by controlling insect damage to crops.

The Entomological Section of the Madras Agricultural Department was organised during the year 1912. The work has not always been quite an enviable one since it consists in organising a regular, unrelenting warfare against Nature, who, while having blessed us with her unlimited and bountiful resources, has also created the myriads of insect foes for us to contend with. Perhaps the chief handicap which has all along been felt was the inadequacy of staff, to transmit what little had been achieved by way of research, promptly and in time to the door of the ryot in times

of emergency. The situation was at no time more seriously felt, than during the present food crisis, when the resources of all governmental agencies had to be mobilised to save every plant raised and every grain harvested. The first urgent demand on the entomologist was during 1943, when a consignment of over 6,000 tons of imported wheat was threatened with complete ruin by insects at Madras. Since then the conservation of the large stocks of foodgrains, held in storage by the Government, from insect damage has become a routine work of the special entomological staff. In the wake of the above problem, the vagaries of the monsoons and other environmental factors, have favoured the multiplication of some of the major pests of field crops. Some of the forms which were till now dormant suddenly assumed serious proportions, while some others, which were practically insignificant so far, flared up into prominence. The recent intensive practice of crop cultivation, which has for its incentive the attractive prices of food stuffs, has been an important factor aiding the rapid multiplication of insect pests. The seriousness of the situation was realised by the ryots also and frequent requisitions for help and advice were pouring in from all parts of the Presidency. The experience of previous years, coupled with the discovery and easy availability of the two new insecticides - DDT and B. H. C. have enabled the section to rise to the occasion and handle the situation satisfactorily. More than that, the timely organisation of a separate plant protection agency for the Presidency, has been of immense help in transmitting the results of research to the ryots and popularising the approved methods of pest control. The object of this paper is to present a short account of the work done in this line.

The activities of the Entomology section may be classified under two categories, viz. (i) Protection of food-grains and (ii) Protection of crops and plants.

(i) **Protection of food-grains.** This branch though it was first organised to meet emergent cases of grain infestation, has subsequently become practically a food-grain protection service, in 1943, when the food crisis was just making itself felt, alarming reports were received about the badly-weevilled condition of about 6,000 tons of wheat imported from Australia. Immediate steps were taken to investigate the complaint and fumigation with calcium cyanide was decided to be the only resort. Suitable accomodation and the necessary machinery were improvised and the entire consignment was fumigated with success. Meanwhile, the Government also programmed the policy of importing enormous stocks of food-grains and keeping them in storage for a regulated issue to the public. This procedure created in its wake the problem of insects also. Investigations were immediately taken up to find out the ways and means of conserving the stocks and the following standardised policy was evolved and adopted. Experiments had shown that Calcium cyanide was about the best fumigant and that DDT and B.H.C. dusts were good disinfectants as well as prophylactics. Empty godowns are first cleaned and dusted

with one of the latter chemicals to eliminate the insect population, lurking in the corners and crevices. The bags are subsequently stacked according to specifications and if they get infested, they are fumigated with Calcium cyanide, Initial or re-infestation of the stocks is prevented by a periodical dusting on the bags with BHC D. 034. Adequate precautions are taken to see that the grains do not get damaged by the treatment. A technical staff of four officers with a complement of subordinate staff is attending to the work in the whole Presidency and the entire organisation is under the administrative control of the Board of Revenue. It is unnecessary to dilate here about the volume of the work turned out by this service, but it would suffice to say that food-grains are handled by lakhs of tons and every attempt is made to minimise the loss by insects.

(ii) **Plant Protection Service.** A plant protection staff comprising two officers one stationed at Bapatla for the northern districts and another at Coimbatore for the south – with an upper subordinate for each district specially trained for the work was sanctioned during the current year. The scheme began to function by about the middle of January, 1949. Each district was also furnished with the minimum equipment of dusters, sprayers, and the standard insecticides to meet all emergencies. The period under review, though short, had been unique in the successfully tackling of a number of major pests, mostly of food crops. Paddy which happens to be one of the staple crops of our Province had to suffer severely, from its insect enemies. The army worm of paddy *Spodoptera mauritia* broke out in all its virulence ever the Circars, West Coast and parts of the Tamil-Nad and about 640 acres of nurseries and 5.500 acres of planted fields were infested. Prompt control measures, such as flooding and sweeping the caterpillars were organised. Dusting with BHC D. 025, the latest insecticidal treatment was also advocatad, An acre requires about 10 to 20 lb. of the chemical costing about Rs. 8/- and this expenditure was not grudged by the ryot, as over two and a half tons of this chemical were purchased and used by them in the Circars alone. The rice grasshoper – *Hieroglyphus banian* – appeared on a large-scale, over 6,000 acres in Malabar and the latest methods of control were adopted with success in this district also. The same chemical – BHC D. 025 – was equally effective against the grasshoppers also and its use is rapidly becoming very popular. Another serious pest of paddy, is the paddy jassid – *Nephotettix bipunctatus*. Among the various chemicals tried, for the control of this bug DDT spray at 0.1% concentration was found to give very good results at a low cost of Rs. 6/- per acre. The pest appeared again this year over 300 acres in the Tamil Nad and was dealt with promptly. An effective remedy by way of dusting BHC D. 025 was discovered against the rice bug — *Leptocorisa acuta* — and this campaign was pushed on about 100 acres. The cost is neglegible compared with the probable damage, as it works out to less than Rs. 10/- per acre. The damage by the common field rats — *Gunomys Kok* — is being reported to be far more serious than that caused by most

of the other pests. Control measures advocated and practised, so far, were not convincing. The recent astounding results obtained with zinc phosphide used as a poison bait have practically solved the problem. The mortality of the rodents was so convincing that over 2,000 lb. of the chemical, enough to treat 20,000 acres were recently purchased and used by the ryots of the Northern Circars. Apart from the major pests, minor ones such as the smaller grasshoppers — leaf-eating caterpillars and beetles, plant bugs, etc., occurred sporadically in isolated areas and suitable measures were adopted. Crops coming under the category of millets also were subject to infestation by grass hoppers, the ear-head bug, etc., and all these were successfully dealt with. In the case of vegetables, hundreds of acres of brinjal were protected for its specific enemy — the *Epilachna* beetle, not to speak of other insects which infest this crop. The new insecticides have also been equally effective and were used on a large scale against thrips on chillies and garlic. Remarkable results were obtained against cutworms on potatoes and cruciferous crops on the Nilgiris with BHC D.025 which practically annihilated these worms and its use is becoming increasingly popular. Besides these, a number of pests on fruit trees, industrial crops like betelvine, oilseeds, etc., were promptly attended to. The research section at Coimbatore is, in the meanwhile, busy with finding out new methods of combating the insect foes. Interesting results have been obtained against a number of insects such as the pomegranate borer, the ber fruit fly, the agathi weevil, the mango hopper, etc., which were till now defying all our ingenuity and these will be popularised as soon as the tentative results are confirmed.

The resume of the work given above would serve to show clearly that the staff appointed have more than justified their existence. The benefits to the public by the grain storage service alone is enormous. Based on the encouraging results obtained so far, the Board of Revenue are seriously considering the expansion of the staff. The plant protection service under the Agricultural Department, though hardly six months old, has turned out creditable work and its future possibilities also are immense. Apart from carrying out the approved methods of control, the staff are also taking up field observations as and when there is need and it will not, be long before this Department has to approach the Government with proposals for expansion in this line as well.

Before concluding this note, it is also my duty to point out one major aspect, which seriously handicaps the efficiency of the service. Insect outbreaks generally occur all on a sudden over large areas and effect considerable damage before help reaches the place. In these days of acute transport difficulties, it has not always been possible to reach the workspot promptly, with the somewhat cumbersome and heavy appliances and large consignments of insecticides. Provision of a few mobile units for each division would go a long way to solve the problem and make for efficient service.

Some aspects of the transmission of the results of research into general farming practices

By

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Introduction: The ultimate aim of research in any branch of science is translation of its results into productive action. Most of the general public are interested in what is known as applied research alone and not in the fundamental work that must have preceded and been responsible for the results which are capable of direct application to specific purposes.

2. **Agricultural Research cannot be spectacular**: The results of agricultural research have got to be carried to a huge number of cultivators scattered over large areas and with varying economic status, and cultural development, unlike in the case of industrial research in which only a few resourceful and capable industrial magnates are primarily interested. Hence, the problem of translation of the results of agricultural research into productive action is very difficult. In many cases the benefits of the application of agricultural research are seldom spectacular and they are never immediate in the sense that they can be seen next day. For instance, by reducing seed rate in paddy and sugarcane the immediate benefit to an individual ryot is not spectacular. From about 80 lbs. of paddy seed sown in 8 or 10 cents to plant one acre, if it is reduced to 35 or 40 lbs. the saving of 40 lbs. costing at the present rate Rs. 4/- to 5/- is a mere nothing to the cultivator. But when the cumulative result of all the ryots adopting this method is visualised, the real benefit to the community in terms of the vital grain so urgently needed can be appreciated. For planting the 1,00,00,000 acres of irrigated paddy in this province about 10,00,000 acres of nurseries have to be sown. By adopting the improvement suggested, above 4,00,00,000 lbs. of paddy grain can be diverted for human consumption without merely going to waste. Similarly, in the case of sugarcane, reduction and seed rate from say 20,000 to 15,000 sets per acre results in a saving of 5,000 sets weighing about a ton. A ryot who is spending upto Rs. 1,000/- towards cost of cultivation does not feel the pinch of the extra expenditure of Rs. 40/- or 50/- towards cost of one ton of cane seed and hence may not bother to change his usual methods. But from the point of view of the province there will be a saving of 2,70,000 tons of cane (according to the latest available cane area) costing over rupees 121·5 lakhs. Thus if all the cultivators view this in such a perspective it is easy to spread this improvement and the agricultural prosperity of the country can be enhanced.

3. **More research and demonstration farms necessary**: This is a country of distances. Some of the districts in this Presidency are as big as some of the kingdoms of Europe and yet we do not have an agricultural research station for each district at least. Results achieved at a central research station cannot be applicable to distant places. For instance Co. 421 classified as a midseason maturing cane at Anakapalle was found to mature earlier in the Bobbili area. As a rule, cane varieties are earlier to mature at Gudiyattam than at Anakapalle. But the performance of the varieties in the Chodavaram area which is very near to the Sugarcane Research Station, Anakapalle, is practically similar to their behaviour on the research station. Hence the results achieved at any station can be straight away recommended for adoption only in neighbouring localities. But the research stations in this Province are few and far between and the improvements recommended by any station have to be further tested in the locality where they are sought to be introduced and in this process of testing and retesting a large amount of avoidable delay is caused. This delay is a check to the process in the popularisation of these results and increase the national prosperity, which will accrue by the adoption of these improvements. It is necessary to have at least a main research station for each district with liaison farms or demonstration farms in each important locality of the district to ensure easy and quick spread of the results of research into general farming practices. In this connection starting of farms like the Sugarcane Liaison farms is a very welcome feature. Important results achieved at the main research stations can be demonstrated here on field scale and problems of local importance tackled. If there are enterprising ryots or industrialists of the locality who are prepared to co-operate in the working the liaison farms their help may be sought for that purpose.

4. **Raising of economic status of cultivators is crux of the problem**: As mentioned in para two, the results of agricultural research have to be translated into farming practices by the cultivators who differ very widely with regard to their educational attainments and economic status. Education apart, it can be said emphatically that our ryots are more than shrewd, to understand the benefits accruing from a really good improvement. It is their economic status that mostly cripples their initiative to adopt some of the improvements suggested by the department. Nanavati and Anjaria, writing in the Indian Rural problem, held that nearly 70% of the holdings are uneconomic units in this country. Moreover, a large number of the cultivators are only tenants who have no permanent interest in the land they till. Writing about the Punjab peasantry in an article entitled 'Some thoughts on yield', Martin Leake said that the greatest handicap for the popularisation of results of agricultural research, was the low economic status of the peasants. The Punjab peasant is probably the richest man when compared to cultivators of the other provinces since he has organized irrigation and other facilities.

If he himself could not adopt all the improvements suggested by the local agricultural department, it can easily be realised that there is less scope for the Madras ryot, who is more often than not a tenant cultivator, to take up all the improvements.' Leake was referring to the average yields of wheat after thirty years of agricultural research in the Punjab. In spite of evolution of several high yielding strains and their spread to some extent the provincial average yield per acre did not go up, and was on the other hand slightly less than what it was three decades back. So unless the economic condition of ryots is generally improved they will be unable to adopt the suggestions given by the department to the fullest extent.

5. **Publicity is not enough:** It is recognised on all hands that advertisement is a fine art which needs a thorough training. There is no institution in the Province which trains persons in the arts of propaganda and publicity. It is a vital necessity to start such an institution and train suitable technical personnel for popularising the results of research and translating into general farming practices. To supplement the grow more food journals which are now primarily engaged in publishing the results of research in a popular manner in the regional languages the output of leaflets and pamphlets has to be increased to a great extent. These should be on the lines of the Farmer's Bulletins published by the United States Department of Agriculture dealing in detail with some aspects of cultivation in non-technical language in the local vernaculars.

6. **Role of vested interests:** There are instances of enactment of laws to control pests and diseases such as groundnut caterpillar, sugarcane smut and wheat rust. Similarly in some extreme cases, legislative compulsion seems to be necessary to push through agricultural improvements in certain localities. For instance in the vicinity of a big sugar factory of this province simple cultural improvements which are within easy reach of the cultivator are not taken up to increase the sugar recovery percent. There is the instance of sugar factories delimiting areas under high yielding and less rich canes. Thus, when there is a clash of interests the more powerful and resourceful person is getting the better of the other and thwarting the popularisation of really good improvements of national interest. More sugar per unit area is the main aim of the department, and more cane per acre is the aim of the factory ryot, whereas more sugar per ton of cane is the aim of the sugar factories. Legislation to control the activities of interested individuals or institutions who do not care for the larger good of the country has to be passed for translating the results of research into general cultivation practices with the ultimate aim of increasing production.

7. **Starting of co-operative societies:** Improvements involving investment of large sums of money can be popularised only by providing cheap credit to the needy cultivators. It is best done by encouraging and

helping formation of co-oparative societies. For instance, purchase of manures or insecticides or implements in a collective manner just in time for utilisation at the opportune moment, is possible through a co-operative society. New, anxious cultivators who wish to manure their crops early are being exploited by designing money lenders, by the imposition of exhorbitant conditions attached to the loan. The ryot is in many cases forced to sell his produce at comparatively cheaper rates to the money lender himself. Instances in abundance of such cases can be seen in Chodavaram and Anakapalle area in the Vishakhapatnam district. These irregularities can be avoided and even small ryots who are unable to manure their crops due to want of finance can also be benefited by becoming members of such societies. Another type of help which the co-operative societies can render to the farmers is construction of godowns and warehouses for storing produce to be sold at an advantageous price after some time. Jaggery manufacturing ryots knew to their cost how they lost heavily this season by selling their produce in December — January at 40 to 50 rupees per candy of 500 lbs. instead of at over 100 rupees per candy in May — June. By building warehouses as per departmental advice and giving advances on produce sold, the societies not only help in the spread of agricultural improvements but also help to raise the economic status of the cultivators which is a vital necessity for the rapid spread of the results of research into the general farming practices.

Summary and conclusions: The results of agricultural research have got to be carried to wider and a heteregeneous population unlike that in the case of other types of research. Agricultural research is less spectacular and the economic status of the ryots in many cases does not permit of their taking up certain improvements in the opportune time. Hence it is more difficult to translate the results of agricultural research into practical channels than in the case of other types of research. Many more research stations have to be started in representative localities for solving problems of local importance and facilitating recommendation of the results of research in the neighbouring tract. Liaison or demonstration farms have to be set up in as many places as possible for demonstrating the useful results achieved at the main research stations and quicken the popularisation and spread of the various improvements. Just as in the case of some diseases and pests legislation has to be passed if necessary for spreading certain improvements. Formation of co-operative societies will facilitate collective purchase of useful implements, manures, and insecticides etc. and will help in the spread of certain cultural practices recommended as a result of research over a number of years.

A note on the cultivation of Tapioca and derivative food products from it

By

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Tapioca and sweet potatoes, on account of their large carbohydrate content have an important place in the existing food economy of the country. With intensive propaganda on the use of these as vegetables as dehydrated or sundried chips, as flour or sago, it is possible to supplement the shortage of cereal production. It is said that even in the past, during periods of famine, tapioca and sweet potatoes have helped in tiding over the difficult period. What would have been otherwise a hopeless famine in the past has been reduced to a mere food crisis, with the aid of these subsidiary food crops.

Sandy loams, of five to six feet depth in preferably not low-lying areas are the best suited for tapioca. Loamy soils with a smaller percentage of sand are less suited for this crop, due to the greater resistance offered for the full development of the tuber. About four or five deep ploughings are given usually as preparatory cultivation. Five cart loads of mill wastes or ten cart loads of greenleaf are spread on the soil and covered well.

After levelling, the field is divided into two feet squares, both lengthwise and breadthwise. The best season for planting on high level lands is from June to September. In low levels it will be advisable to plant from October to January. The essential point to remember is that there should be very little moisture at the time of planting and about a month or two thereafter. Hence early plantings in low lying lands at the beginning of the monsoon will handicap tuber development on account of too much moisture in the early stages in the root zone.

Planting material. Full length shoots, immediately after harvest are planted in a cluster called "Podies", which are channels, 2 ft. wide 3 ft. deep and 10 ft. long, where one and half cartloads of shoots are placed vertically and covered up with earth, If there is sufficient moisture in the soil no irrigation is given. Otherwise it is moistened with a little water. The 'Podi' is said to be ripe for seed material usually after ten or twelve days when leaf buds just begin to put in their appearance. The latex in the shoots at this stage will be at a maximum. Each shoot is cut into nine-inch long sets and planted. Usually a "Podi" will provide sufficient material to plant an acre. On no account should a 'podi' be allowed to mature for more than a fortnight

or till the leaf buds change into leaves, as it then indicates that rooting has taken place at the bottom. Sets from such over mature shoots make poor seed material. The latex content in over mature shoots of 'podies' is considerably less and shoots also become pithy.

For introducing in new areas where the seed material is not available in the neighbourhood, it is best to take the shoots from the fields immediately after harvest, transport them expeditiously to the destination and to put them into a 'podi' in the new area. Even here the shoot must be planted in 'podies' within 4 days. Seed materials from 'podies' of growing areas, however quickly they are transported has not given satisfactory viability. It is due to the fact that the latex content dries up very rapidly and the usual precautions of covering them during transport do not prove of much use.

Seed rate and planting. Usually a 'Podi' or a cartload and a half of material cut into nine-inch sets give about 12,000 sets and this will plant an acre. The sets are planted vertically at every junction of the two feet squares, one each, more than two thirds of the length being inside the ground level. If there is not sufficient moisture, one irrigation is given. The plants will begin to root and put out green leaf buds in about a week.

Intercultivation. Hoeing between the rows is done once a week in the first two months and once a fortnight for the next four months. Irrigation is given once a week when there are no rains. For normal plantings, beds containing five plants each way, are formed usually in January or February, as the south-west and the north-east monsoons will be able to provide enough water between the two, upto the end of December. After January, irrigation has to be continued right upto the day of harvest, once a week if the maximum yield is to be obtained. But in great many cases due to scarcity of water in the wells, the plants get hardly any irrigation but even there, it is found the yield is good enough to leave a margin of profit to the growers.

Harvesting: Just before the actual harvest commences the field is irrigated once. It is advisable to harvest early i. e., when the crop is six to eight months old, for marketing the crop as a vegetable. But, for making sago or flour or chips, it is better to allow the crops to stand for full eleven or twelve months. Actual harvesting operation is done by a man gripping the bottom of the shoot with both the hands firmly, with legs planted squarely and pulling out. In a few cases where portions of tubers remain lodged in the soil they are dug out with the mammuti. The pulled-out tubers are cleaned, steeped in mud and carted either to the market or to the factory as the case may be. The steeping in the mud is necessary for preserving the freshness. By this means, the tuber can be kept fresh for four days. Twenty labourers can pull out,

and clean, an acre's produce, i. e., about four tons. Even where the plants are fully twelve months old, the tubers can be kept on in the ground for another six months without damage. This is a favourable point for the sago manufacturer, as it gives him time to prolong his working period.

Yields: A normal crop gives eight to ten cart-loads or four to five tons of tubers per acre. Even where the irrigation has been inadequate the yield is two to three tons per acre. The best tubers weigh 9 to 10 lbs. though the general average will be only one pound or so. When sold as a vegetable a viss or $3\frac{1}{8}$ lbs. at $2\frac{1}{2}$ annas will fetch a return about 400 to 500 rupees per acre. After meeting the working expenses a normal crop leaves him Rs. 100/- per acre as net profit.

Manufacture of Sago: (As a cottage industry): Robust, well developed, freshly-pulled-out tubers are brought to the factory site. The outer skin is peeled off, either with hand or with a knife. The peeled tubers are scraped into fine, uniform shavings by means of a hand-driven scraping machine. The scraping machine consists of a horizontal spindle with sharp, small curved spikes or projections over its entire surface. In the middle of the rotary there is a two-inch wide groove. The rotary is connected to a cranked wheel, by means of a circular rope which passes round the wheel and along the grove of the rotary like a belt drive. By turning the wheel the rotary begins to rotate on its own axle. While it is rotating the tubers are gently pressed against its surface and the shavings that fall off are collected in a tray placed underneath. The shavings so collected are taken to a cement tub, and mixed with water. They are then transferred on to a cloth and strained. The out flowing liquid is collected in another cement tub, with plugged outlet holes at different levels. After two or three hours of standing, a floury white mass settles down and the supernatant water is drawn out by unplugging one of the outlets. The white powdery residue is dried for an hour or two and sieved by means of a special superfine meshed sieve till all the fine flour is separated. The coarse flour is mixed with the next charge in the first tub. The sieved fine flour is placed on a clean, dry white cloth and oscillated gently till they form into uniform small pellets. These are then graded by means of a suitable sieve, bagged and sold as sago. Coalesced pellets and the coarse grain are marketed as *tapioca rice*, at a slightly cheaper price.

The pulp, left over after straining the starchy liquid is dried and fed to cattle or made into fine flour and sold about at Re. 1/- per maund of 25 lbs. for making kumkum (saffron) or as a substitute for Fuller's earth, or kieselguhr for making face powder of a cheaper quality. One ton of tubers give one sixth of a ton of sago. During the war period a maund used to sell about Rs. 20/- and one acre's produce used to bring in a gross return of Rs. 1,200/-. The sago so manufactured keeps on its quality unspoiled for nearly a year.

Chips: (Sundried). After peeling off the skin, the tapioca tubers are cut into slices half an inch long and sun-dried for two days. This is used for curry or mixed in cooking along with meat and put to several other culinary uses. Fifty maunds of tubers give sixteen maunds of sun-dried chips or nearly one-third of it. The chips keep unspoiled for four or five months, provided it is sun-dried once a month.

Flour: Well-dried or dehydrat d chips are ground into fine flour and used as a substitute for rice flour, for almost all the preparations where rice flour happens to be the main constituent. Sixteen maunds of chips give about 13½ maunds of flour. The flour keeps on unspoiled, up to six months with occasional sun drying. The war-time price of flour used to be Rs. 45/- per cwt. The present price is about Rs. 22/- per cwt.

There is a great future for the growers of these subsidiary crops; with proper propaganda on the nutritive value of tapioca and sweet potatoes, many low-yielding sandy loams can be brought under these root crops with little expense and great profit. At present, the following factors are hampering maximum production. More than 50% of tapioca crops come to harvest after inadequate irrigation, due to want of water in the wells. A concerted drive to sink boreholes with the Government supplying the necessary equipment, even on a hire basis, will go a long way towards remedying the dearth of irrigation water. By starting processing factories for manufacture of sago and removing the export restrictions, and by conducting intensive propaganda for making greater use of the products of tapioca by the common man, the consumption and production of this crop can be stepped up to a considerable extent. Allotting manure purchase loans without interest at the time of sowing and collecting the same after harvest will also help the grower to increase the area under this useful food crop.

Natural crossing in Cumbu Pennisetum typhoides Stapf. and Hub.

By

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Cumbu or *Bajra* is the second important millet of Madras coming next to sorghum. It occupies an area of 2·6 million acres in the Presidency and produces an outturn of 6,85,5000 tons of food grains annually. The natural crossing in cumbu was studied with a view to evolve high yielding hybrid strains in the crop, as a first step in it.

The ear of cumbu is a compound cylindrical spike whose length varies from 8″ to 15″ with a thickness of about one inch to 1½ inch according to the varieties. The spikelets are commonly in clusters of two. In each spikelet there are two flowers. The third lemma bears a male flower and the fourth lemma bears a hermaphrodite flower. The most peculiar feature of the floral mechanism in cumbu is its protogyny. In the progress of flowering, the emergence of the stigma proceeds from apex to the base. This process is completed within three days. On the fourth day the anthers of the hermaphrodite flowers (whose stigmas had already emerged) start protruding and shedding their pollen. This wave also starts from the apex of the head and proceeds similar to the stigmatic wave and is completed in about three days. Finally the anthers of the male flowers of the third lemma start a secondary wave of a pollen supply and complete the work of pollination in three days.

The inflorescence of cumbu, in the stigmatic stage, whose period is about 3 days, courts cross pollination, the extent of which depends upon the availability of foreign pollen. After the three days period, the anthers of the same flower start shedding their pollen and the chances of cross pollination are then reduced to the minimum. With a view to take advantage of this floral mechanism which favours cross pollination, in the evolution of hybrid strains of cumbu, the intensity of natural crossing in this crop was studied at the Millet Breeding Station, Coimbatore, together with the methods by which crossing in nature could be intensified. In the monsoon season of 1948 (September to December) an experiment was laid out with the following variations to estimate the extent of cross pollination that takes place in this crop, under each treatment. The two selected parents were sown under the following conditions (the progeny of the plant selected to serve as pollen parent is designated as the "male line", while the stigma parent as the "female line"):—

1. *Interval of time:* The two parents were sown in adjacent lines (two links apart between the lines) on (a) the same day, (b) with an interval of three days between the sowing of parents, (c) 5 days interval and (d) 7 days interval. The object of this treatment is that the earlier sowing of the pollen parent may facilitate the synchronisation of the emergence of the anthers of the male with that of the stigmas of the female and help in obtaining greater amount of crossing.

2. *Interval of time and space:* (a) Parent lines one link apart sown on the same day, at 3 and 5 days interval and (b) lines 4 inches apart sown on same day, at 3 and 5 days interval.

3. *Shaking the male lines:* The plants in the male lines were shaken several times in the day to facilitate the shedding and free dispersal of pollen. This was tried in sowings done on the same day, 3 and 5 days interval between parents.

4. *Seeds of both the parents mixed and sown in the same line:* The seeds of both the parents were mixed in the proportions of female to male 1 : 1, 1 : 2 and 1 : 3.

5. *Artificially pollinated:* This was done by bagging the heads in female lines and hand pollinating them with pollen from the plant from the male line morning and evening for 3 days till the anthers of the female began to emerge. No emasculation was attempted. This treatment was used for comparison.

The pollen parents that were used in the experiment had the dominant purple colour in the vegetative parts. The female lines were harvested and the seeds from them were sown in beds. Counts of purple plants that appeared were taken and the percentage of out-crossing which took place was estimated as presented below:

Extent of Natural Crossing in 1948 (Rainfed crop)

Treatment		Percentage of amount of natural crossing obtained (Average of 2 replications)
1. Interval of time (parents sown in alternate lines)	Sown same day	77·8
	„ 3 days interval	64·7
	„ 5 days „	41·4
	„ 7 days „	38·9
2. Interval of time and space (Parents sown in alternate lines)	(a) 1 link apart	
	Same day	69·9
	3 days „	54·2
	5 days „	32·4
	(b) 4 inches apart	
	Same day	27·7
	3 days „	27·3
	5 days „	38·0
3. Shaking plants in male lines to shed pollen (Parents sown in alternate lines)	Same day	55·1
	3 days „	42·1
	5 days „	52·6
4. Seeds of both the parents mixed and sown (in same lines (proportion of female to male)	1 : 1	59·6
	1 : 2	45·4
	1 : 3	75·7
5. Artificially crossed by hand pollinating the stigmas, without emasculation.		88·3

The season was normal for the cumbu crop throughout its growth. In group (i) where interval of time was introduced, the sowing of the parents on the same day gave the highest amount of natural crossing,

being 77·8%. The female parents sown in alternate lines, 2 links apart with intervals of 3 days, 5 days or 7 days in the plot after the male lines were sown, were crowded out by the male lines and they made very poor growth. Moreover, as there were several tillers which were later than the main tillers, there did not appear much point in adjusting the sowing so as to synchronise the emergence of anthers and stigma in the two parents in the group of treatments (2) where intervals of time and space were introduced the closer spacing of 4 inches between lines did not show any advantage. The closer spacing gave poorer plants. In this group also sowing them on the same day was better. In treatment 3, the shaking of plants in the male lines did not improve matters. The cumbu plants shake with every little wind and shed the pollen easily. It did not require artificial shaking to accentuate it. In treatment 4, the 1 to 3 mixture, gave 75·7% cross pollination and the equal mixture gave 59·6%. From the practical point of view, plants intended as be adopted only when it is possible to recognise the plants intended as male parents and eliminate them in the harvest. In treatment 5, artificial pollination, a crossing of 88·3% was obtained. This is the ideal that could ever be possibly reached in this crop.

The data presented above are from the main season of 1948. The experiment will be repeated in the coming season. In the evolution of hybrid strains in cumbu the extent of natural crossing plays an important part, because the percentage of hybrid seed in the "hybrid strain" evolved depends on it. The hybridisation between the chosen parents will be left to nature. This method of work is somewhat different from the hybrid maize work where cent percent crossing could be obtained owing to the monoecious nature of maize, while in cumbu the hermaphrodite nature of flower makes it impossible to eliminate self pollen, and the only help that could be obtained is the protogynous nature of the cumbu flowers.

Summary: The extent of natural crossing in cumbu (*Pennisetum typhoides*) was determined at the Millet Breeding Station, Coimbatore, in the monsoon season of 1948 under different lay-outs of sowing of the parents. The amount of crossing varied from 27% to 8 ·% according to the treatments. The higher amounts of crossing were obtained by sowing the parents in adjacent lines 2 links apart on the same day (77·8%) and also by mixing the seeds of the parents in the proportion of one female to 3 male (75·7%). This study was undertaken with a view to produce hybrid strains of cumbu in which natural crossing will be the factor in hybridisation. The work will be different from that on hybrid maize owing to the differences in the floral structure of the two plants, as maize is monoecious while cumbu is hermaphrodite. The only help is the protogynous nature of cumbu flowers.

A preliminary note on the statistical analysis of the maximum temperatures at Coimbatore

By

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&

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Paddy Specialist, Coimbatore

Introduction: "Climate and weather are as decisive in the development of a plant as home surroundings are in the life of a growing child" (5). The truth of this statement can be understood well if temperature, moisture and light having maximum influence on plant life, are analysed for their relative importance, individually as well as collectively. Every Agricultural worker knows that these three factors always work together to produce a given effect.

It is proposed to confine the discussion in this paper only to *temperature* and its influence on plant growth. Temperature has got both direct and indirect effects on the performance of a plant, directly by affecting its physiological process and indirectly by the spread or inhibition of its diseases. The killing effect of low temperatures, stem lesions and plant diseases caused by excessive heat, diseases due to low temperatures and sun-scalds, and winter-injuries of fruit trees are some of the well-known instances of the influence of temperature on plant growth. It may even go to the extent of controlling duration and seasonal growth habits in some of the cultivated cereals, as for instance, wheat.

Since temperature is an important weather factor controlling the growth and yield of cultivated crops, the statistical analysis of the daily maximum temperatures recorded at 0822 hours in the observatory attached to the Agricultural College & Research Institute, Coimbatore for a period of 36 years (1913 — 1948 both inclusive) has been taken up for detailed study.

Statistical Analysis: (i) The monthly means of maximum temperatures and their corresponding standard deviations and coefficients of variability were evaluated and are given in Table I, season-war. (ii) The twelve inter-monthly correlations with their corresponding standard errors are given in Table II. (iii) (a) Since the correlations between the monthly means of maximum temperatures of ***February and March & September and October*** are positive and significant, the weekly means of the maximum temperatures of these four months were studied in detail. Table III contains the weekly means of maximum temperatures and their Standard

Deviations and Coefficients of Variability. (iii)(b) The correlations between the various weekly means of temperatures of these four months and their corresponding regressions and nature of significance were worked out. At the beginning of summer, the inter-weekly correlations were found to be highly significant, practically throughout February and March. The possible explanation to the existence of this high positive correlation is the ideal weather condition created by clear skies, feeble air movement and absence of clouds and precipitation', characteristic of the beginning of the summer season. In regard to September and October correlations unexpected weekly combinations of significance were noted and assigned to the onset of the north-east Monsoon.

Interpretiation and Inference: (i) *Table I. Monthly means of maximum temperatures, their standard deviations and coefficients of variability,* (a) Maximum temperature is highest in April and lowest in December. (b) Summer commences in February and lasts upto May. The steady and low value of standard deviation and coefficient of variability for the months of February, March and April indicate that during the summer season, fluctuation in maximum temperature is negligible,

The co-efficient of variability varies from 1·41 to 5·44. It is highest in May, followed by that in June indicating thereby the unsteady nature of weather and the setting in of the south-west Monsoon. Its behaviour is similar in October and November, showing thereby that the north-east Monsoon is commencing. Sudden rise in January points out the withdrawal of the north-east Monsoon.

During the monsoonic periods, May-June to September and October-November to beginning of January, the changes in the co-efficient of variability are very sharp, due to the uncertain weather conditions characteristic of these two main rainy seasons at coimbatiore.

(ii) *Table II. Inter-monthly correlations and their significance.* (a) Barring the two combinations, namely, February-March and September-October, all the other ten inter-monthly correlations are not significant. (b) Towards the end of summer and at the time of the commencement of the south-west and north-east Monsoons and during the north-east Monsoon period, negative correlation exists thereby indicating the approach of the unsteady weather conditions.

(iii) *Table III Weekly means of maximum temperatures and their standard deviations and co-efficients of variability (February, March, September & October).* (a) The steady rise of the weekly maximum temperatures during the months of February and March is a characteristic feature of the commencement of the summer. (b) The fairly uniform mild rise in the weekly means of maximum temperature in September

and slow decrease in the weekly means of maximnm temperature in October point out the setting of the monsoonic weather conditions. (c) In October first week (September 29th to October 5th), co-efficient of variability is maximum, thereby indicating the setting in of the north-east Monsoon. The fairly high and uniform co-efficients of variability in the third and fourth weeks of October confirm that the north-east Monsoon has become steady.

Summary and Conclusion,

1. The nature and types of the correlations, both monthly and weekly, have been analysed in detail. 2. When data for a further period are collected, regression equations can be worked out to forecast the maximum temperature in a particular week based on the knowledge of the maximum temperatures prevailing the weeks preceding. The value of such a forecast is too well-known, particulary to an agriculturist, who is always noted for his eagerness to know the weather conditions in advance. 3. Summer commences in February and lasts upto May. During this period, fluctuation in maximum temperature is found to be negligible. This information regarding the duration and severity of summer at Coimbatore will be of immense use to the farmers of Coimbatore for adjusting suitably their cultural operations. 4. The following details regarding the periods of onset and withdrawal of the two main Monsoons at Coimbatore are brought to light by this preliminary analysis: (a) South-West Monsoon sets in June and continues upto September. (b) North-East Monsoon commences in October and withdraws in January.

Acknowledgment: The authors of this short note are highly thankful to all those who have been responsible for the collection of the meterological data, forming the basic material for this paper.

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TABLE I.—36 Years Data.

Serial No.	Name of the month	Monthly Mean Max. Temp. °F	Standard Deviation S. D.	Co-efficient of Variations %
	Hot Weather Period.			
1.	February	90·1	1·85	2·05
2.	March	94·8	1·74	1·83
3.	April	95·7	1·70	1·77
4.	May	94·5	5·14	5·44
	S. W. Monsoon Period.			
5.	June	88·7	4·24	4·78
6.	July	86·4	2·81	3·25
7.	August	87·6	1·54	1·76
8.	September	89·1	1·99	2·23
	N. E. Monsoon Period.			
9.	October	87·5	2·41	2·76
10.	November	84·5	2·23	2·63
11.	December	83·6	1·18	1·41
12.	January	85·1	2·07	2·44

TABLE III.—36 Years Data.

Serial No.	Details regarding the week	Weekly Mean Max. Temp. °F	Stand. Dev. S. D.	Coeff. of Var. %
	Commencement and early part of summer: Feb. — March.			
1.	Feb. 1st week 1 to 7 ...	88·1	3·68	4·17
2.	,, 2nd ,, 8 to 14 ...	88·8	4·52	5.09
3.	,, 3rd ,, 15 to 21 ...	90·7	4·41	4·86
4.	,, 4th ,, 22 to 28* ...	91·5	4·80	5·25
5.	March 1st week 1 to 7 ...	93·0	3·07	3·30
6.	,, 2nd ,, 8 to 14 ...	94·3	2·65	2·81
7.	,, 3rd ,, 15 to 21 ...	95·0	3·97	4·18
8.	,, 4th ,, 22 to 28 ...	95·5	4·30	4·51
	Commencement of North-East Monsoon: Sept. — Oct.			
9.	Sept. 1st week 1 to 7 ...	88·9	3·89	4·37
10.	,, 2nd ,, 8 to 14 ...	89·1	2·75	3·08
11.	,, 3rd ,, 15 to 21 ...	89·4	3·89	4·35
12.	,, 4th ,, 22 to 28 ...	89·5	3·94	4·40
13.	,, 29th to Oct. 5th (Oct. 1st week) ...	88·7	6·62	7·47
14.	Oct. 2nd ,, 6 to 12 ...	88·5	4·35	4·91
15.	,, 3rd ,, 13 to 19 ...	87·6	5·66	6·47
16.	,, 4th ,, 20 to 26 ...	87·1	6·18	7·10

* In leap years, February 4th week covers 8 days.

TABLE II.

Correlation between the monthly means of maximum temperatures—Agricultural College and Research Institute, Coimbatore.

Serial No.	Details of the correlations worked out		Corr. coeff. r.	Stand. Error S. E.	Corr. significant or not
1.	Between Jan. and Feb.	...	+0·2695	0·1651	No.
2.	„ Feb. and March	...	+0·3939	0·1576	Yes.
3.	„ March and April	...	+0·2286	0·1669	No.
4.	„ April and May	...	—0·0319	0·1714	No.
5.	„ May and June	...	+0·2296	0·1669	No.
6.	„ June and July	...	—0·0079	0·1715	No.
7.	„ July and August	...	+0·2757	0·1648	No.
8.	„ Aug. and Sept.	...	+0·2020	0·1680	No.
9.	„ Sept. and Oct.	...	+0·4639	0·1519	Yes.
10.	„ Oct. and Nov.	...	—0·1128	0·1704	No.
11.	„ Nov. and Dec.	...	—0·0212	0·1716	No.
12.	„ Dec. and Jan.	...	+0·1803	0·1687	No.

Gardenland cultivation around the Agricultural College, Coimbatore

By

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Nowhere else can we find such a sudden and spectacular improvement in the expansion of gardenland cultivation, i. e. farming under well irrigation, as in the Coimbatore district, in recent years. A large area under dry lands have been converted into gardenland by sinking new wells. Starting with a small nucleus gardenland holding, many have acquired, consolidated and enlarged their holdings. Neighbouring drylands have been purchased, often at high prices and added to their holdings. Old wells have been deepened and widened, if the water supply is promising. Investments of Rs. 5,000/- to Rs. 10,000/- per well is not quite uncommon in this district. It is the advent of cheap electricity from the Hydro Electric Power Scheme of Pykara, some fifteen years

ago, that has greatly accelerated the pace of gardenland cultivation. It has given a great fillip to the sinking of new wells, wherever underground water resources justify it, in addition to the deepening and widening of old wells, introduction of improved implements and machinery and the liberal application of manures.

This phenomenal development in such a short period is entirely due to the quick distribution of hydro electric power and the centre of all improvements has been the installation of electric motors and centrifucal pumps for irrigation purposes. It is wellnigh impossible to bring about these improvements in cultivation with bullock power alone. Wells in Coimbatore are deep and rocky the supply of water would usually go down during the summer. Even installations of oil engine pumps cannot be as handy as these electric motors, as these admit of shifting of the installation to temporary beds at different heights. This district is credited with having nearly fifty per cent of the electric motors in agriculture in the whole of Pykara Electricity Scheme and no persuasion was necessary, especially after World War II when the cost of bullocks and feeding stuffs went up enormously. In fact during the war and post-war periods, a large number of applications for the installation of electric motors had to be kept pending, owing to difficulties of getting transformers and electric materials. More and more deepening of wells in order to get a copious supply of water, affect the other wells of the neighbouring holdings with the result that many of these shallower wells in the course of time become derelict. This happens as underground water is devoid of any natural springs in this area. Such difficulty may be overcome by suitable legislation, directing payment of compensation for the loss incurred. Pumping with electric motors has taken off the very heavy strain on bullocks in lifting water from deep wells, resulting rapid deterioration of the animals. Now pairs do only ploughing, carting and other work on the farm and this has improved the condition of animals very much. This has also reduced the number of pairs required to be maintained on the farm, in addition to the reduction of areas devoted to the growing of fodder at the expense of food and commercial crops.

Incidentally this has induced the farmers to take up to improved methods of agriculture. Already improved tillage implements are being adopted in most of the farms. Several types of soil inverting iron ploughs are used in this district in the cultivation of gardenland crops. In the cultivation of cotton and also for sugarcane, the ridge plough is very commonly used for forming ridges as it is definitely cheaper than getting the work done with manual labour, at the rate of 8 to 10 men per acre. The bundformer is even more popular and economical in the cultivation of summer cholam and ragi cultivation in forming bunds or beds, thus saving a lot in labour costs. What would ordinarily cost by employing

20 men for 4 acres at a cost of Rs. 30/- can be easily done with one pair, one men with four more men to correct them on four acres a day costing in all about Rs. 10/-. The Junior Hoe is another useful implement used in the inter-cultivation of cotton for effective weeding. These implements facilitate quicker operations and cover a larger area and thus effect a large saving in manual labour.

Heavy manuring is a characteristic of this type of cultivation in the Coimbatore district. Application of municipal compost and tank silt from nearby tanks to increase the fertility of the soil is a common practice, in addition to the application of cattle manure from their own farmsteads. Application at the rate of 100 to 200 cartloads per acre is not unusual. Such heavy manuring is done once a year for the cereal crop that is grown first. Chemical manures are rarely used for manuring round the college for gardenlands.

A readiness to try new and improved strains of millets and cotton evolved by the department is another notable feature among these ryots. Strains are so selected to suit the rotations followed by them without much overlapping of crops. The larger gardenland owners have an effective command over labour; the wages paid are not higher than the market rate nor the hours of work smaller. The labourers are even prepared to work a little longer or receive slightly lower wages in these bigger farms, in view the continuity of work which the farm provides throughout the year. This is possible in diversified farming on large blocks of gardenland. Permanant farm servants are alloted more responsible work and are given free quarters in the farm, with sundry perquisites on festive occasions.

The common rotation followed is growing of two or three crops in a year. The cropping is so adjusted to have two cereal crops, one for cattle and the other for human beings and one money crop. The climatic conditions in the district are also such as to facilitate such rotations. Unprecedented increases in prices after war, have not only made these ryots rich, but also have enabled many of them to save up something for the future. The main cultivating classes are the Kammava naickers and Vellala gownders who are closely in touch with agriculture, in spite of their other avocatious. Some of the land-holders earn large incomes from non-agricultural sources also and are able to invest in purchasing, consolidating and enlarging their holdings. Such an expansion of area under gardenlands would not have happened but for the keen interest in investing their money on land to get better returns by various improved methods.

A number of holdings around the college were enquired into, to find out their earnings during the year and their approximate income and expenditure are tabulated below :—

Table showing Income and expenditure per acre of cultivation of three holdings

	Holding No. 1 11 acres - one pair 2 permanent coolies 11 acres Ragi and 11 acres Cotton	Holding No. 2 6 acres - and 1 acre wetlands. 2 pairs and 3 permanent coolies. 3 acres Ragi and 3 acres Cholam and 6 acres Cotton	Holding No. 3. 11 acres and 1½ pairs and 2½ permanent coolies Ragi 5 acres and Cholam 5 acres and Cotton 10 acres
Expenditure			
Ragi	227	187	172
Cholam	...	110	127
Cotton	69	66	62
Total	296	363	361
Income			
Ragi	296	265	292
Cholam	...	363	362
Cotton	860	625	730
Total	1156	1253	1384
Less cost of maintenance of pairs and permanent coolies per acre owned.	190	356	173
Nett income ...	670	534	850
	Average ...	685/-	

Note :— Holding No. 2 has additional income by sale of milk and milk products. About Rs. 350/- per year from one acre of paddy is also obtained by holdings No. 2 and 3. Maintenance of pairs is worked at the rate of Rs. 2—8—0 per day and the yield is valued at the controled rates. Depreciation on the capital investment is not included.

Holdings around the college are managed entirely by the members of the family. New methods of cultivation are sought after and practised in a manner that would strike any student of agriculture with amazement. On an average a cultivator gets about Rs. 685/- from three crops grown in one acre of land. As this is quite a substantial amount it is no surprise to see that the gardenland cultivator is often very much better off than his neighbouring dryland or wetland cultivator. They generally maintain a higher standard of living. The prosperous state of the gardenland areas of Coimbatore is obviously due primarily to the fact that the farmer has an assured and copious supply of water all through the year for growing a variety of crops and it is this which has induced the Government of Madras to launch out on the well-subsidy scheme for digging more wells and thereby improve crop production.

Economic Planting of Rice

Transplanting is the normal practice obtaining over the larger part of the area under irrigated rice. Fourfifths of the rice grown in the world is transplanted and almost all countries like Spain, Italy, Japan etc., where the highest acre yields of rice are recorded adopt transplanting. The fact that the yield per acre is increased by transplanting is well recognised.

For a long time past the Agricultural Department has been advocating the economic methods of transplanting rice, by the reduction of the seed rate usually adopted. Sturdy seedlings tiller better producing larger earheads. Sturdy seedlings can be raised only by thin sowing of the nurseries. Thin sown nursery produces a better type of seedlings, than in a thick sown nursery. Their early vigour is reflected in a higher yield. Experiments at most of the Rice Research Stations, Samalkota, Maruteru and Coimbatore over a number of years have shown definitely that the crop grown from thin sown nursery always gave increased yield ranging from 6 to 15 percent, compared to the crop raised from thick sown nursery. The Common practice is to sow thick using 7½ to 12 lbs. of seed paddy for each cent of nursery and raising about 5 cents of nursery for planting an acre of the field. Some seeds do not germinate, while some that germinate lag behind in growth. The nursery is over-growthed and the seedlings grow lanky and matted together. The women who transplant have a certain "feel" of the thickness of the bunch of seedlings they hold between their fingers, plant only that number of seedlings that give them that correct "feel". Counts have shown that there are as many as 20 seedlings per bunch thus planted. Associated with thick sowing there is a tendency always for the women to plant in bunches wide apart.

In the economic method of planting advocated by the Department only 3 lbs. of seeds are required for sowing in one cent of nursery, 7 to 8 cents of nursery are required for providing enough seedlings per acre in the case of medium duration varieties or 10-12 cents for Kar varieties. The seedlings grown in such thin sown nurseries are robust and thick and fewer number of them give the required "feel" for the transplanting. Generally, for medium and long duration varieties 6"—8" spacing between the plants and for short duration kar varieties 4"—5" spacing is the optimum. Compared with the common practice of thick sown nurseries, the method of economic planting with a reduced seed rate advocated by the Department gives a saving of at least 25 lbs. (10. m.m.) of seed per acre. By adopting the reduced seed rate over the 10 million acres of paddy in the Province, there will be a saving of nearly a lakh of tons of paddy seed. By this simple improvement in cultural practice in Tanjore District alone, there will be a saving in seed paddy that would be enough to feed its entire population for three weeks. Thus sowing thin in the paddy nurseries, besides giving a definite increased yield assures immediately an appreciable saving in seed. (From the Director of Agriculture).

Agricultural News Letter

Rust Resistant Strain of Korra. The Korra crop in the Ceded districts is invariably susceptible to the disease known as *rust*, characterized by rusty brown spots on the leaves. In certain seasons, when the intensity of the disease is high, the yield of the crop is considerably reduced. A selection S. I. 3756 evolved at the Millet Breeding Station, Coimbatore, has been found to comparatively resist the

disease better than the local. Tests that were conducted for the past three seasons in the Bellary district have conclusively proved its suitability to resist the disease and yield higher than the local. Seeds of this strain can be had from the Superintendent Agricultural Research Station, Hagari (Bellary District).

Improved Strain of Irrigated Cholam. A high yielding strain, K. 2, has been found suitable for cultivation in the two seasons–January,–February and April May, in Tirunelveli district. The strain is short in height and matures earlier than the local by about 10 days. The ear-heads are medium sized and compact with well-set white pearly grains. The cultivation of the strain not only saves the cost of one irrigation but also gives extra produce valued at Rs. 37—8—0 per acre at the present price of cholam.

New Ragi Strain. K. 1. ragi yielding 18 per cent over the local (288 lbs. per acre) isolated at the Agricultural Research Station, Koilpatti, is now available for distribution. The new strain resembles the local in respect of duration ear-head etc., and at the present price of ragi, a net profit of Rs. 36/- per acre is expected out of its cultivation.

Hybrid Cumbu. Two new hybrid cumbu varieties X. 1 and X. 2 were recently released for trial from the Millet Breeding Station, Coimbatore. They have been produced by crossing promising pure lines which exhibited the maximum hybrid vigour when crossed. District trials, conducted in Tiruchirapalli district in the Musiri and Perambalur taluks have been very encouraging. Extensive trials are being arranged in the coming season to find other areas suitable for cultivating the hybrid cumbu X. 1 and X. 2.

Advice to Fruit Growers. Malta, Nepali oblong, Italian, Rajahmandry and Lucknow seedless are the most promising varieties of lemons, which commence to bear within two years of planting. Layers of these varieties are produced on a large scale at the Government Fruit Nursery, Kodur and at some of the Agricultural Research Stations in the Province. About twenty reputed mango varieties introduced for trial from North, Central and Western India, failed to fruit even after ten years of planting at the Fruit Research Station Kodur in the Cuddapah district. Efforts made to induce them to flower by adopting devices such as ringing the trunk and their branches and smudging the trees did not prove successful. The fruit growers of this Province are therefore advised not to introduce for commercial planting fruit varieties from other parts of India, however high their reputation may be, in their native habitat, but plant only varieties of known performance tested by the Agricultural Department.

Green Manure. An acre of paddy field requires 25 to 30 lbs. of small sized green manure seed like Pillipesara, *Sesbania speciosa* etc. Efforts to produce seed of this green manure crop on the paddy field bunds at the several Agricultural Research Stations show that it is easily possible to obtain 25 lbs. of seed from *Sesbania speciosa* planted on the well-trimmed field bunds of an acre of land immediately after planting paddy in July-August. Planting of seedlings is to be preferred to dibbling seed directly on the bunds. Nursery of *Sesbania speciosa* should be sown on a small high level plot four to five weeks in advance of the completion of paddy planting in one's holding. The plants grow quickly and commence to flower in November. Pods ripen by middle of January.

Coconut Seedlings. In order to supply the public with selected seedlings at comparatively low price, a comprehensive coconut nursery scheme financed by the Government and the Indian Central Coconut Committee was sanctioned by the Government of Madras in October 1948, and was put into operation from 10th

November 1948. Eight nurseries have been started at the eight research stations, viz., Anakapalle, Samalkot, Maruteru, Tindivanam, Pattukottai, Coimbatore, Pattambi and Nileshwar. Under this scheme, it is proposed to produce annually 160,000 seedlings to plant about 2,000 acres. Seednuts from selected trees having all the desirable characters will be collected mainly in the months of February to June and the supply of seedlings will commence from July and continue throughout the monsoon months.

Quality in Fruit Products. To prevent a large number of spurious and synthetic fruit drinks with little or no fruit in them but with plenty of essences and brilliant colours being sold under false labels and passed off as first class and real fruit juices, the Fruits Products Control Order, 1948, has been brought into force by the Government of India. Under this order, it is necessary for a manufacturer to possess a licence before opening any fruit preservation concern, and the products manufactured have to conform to certain standards. The Bio-chemist, Government Fruit Products Research Laboratory, Kodur, who is in charge of this order will give guidance and advice to manufacturers already in the field and those proposing to start new concerns.

Pith formation in Sugarcane. Sugarcane stem is generally solid in structure made up of mostly soft tissues full of sugary juice. Under certain conditions of cultivation and weather, the stem forms hollows in the centre or the stem may be composed of dried up non-juicy tissue. Such deterioration in cane is termed as pithiness in sugarcane. This will result in a loss in tonnage of cane and sugar. Hollowness or cavity pith in the stem is generally formed at the base and it spreads to the top. The dried up tissue or corky pith is formed at the top only. Pith formation leads to poor juice quality and low recovery of sugar besides low extraction percentage. Pith formation is a varietal character. C. O. 527 forms large amount of corky pith at the top; C. O. 449 and C. O. 349 form large cavity at the bottom and Pith formation in C.O.419 is comparatively low. Application of a large dose of Nitrogen, arrowing (shooting into blossom) or flowering, too frequent or copious irrigation or raising the crop under swamp conditions and continuous ratooning encourages pith formation. Pithiness also developes when cane is not harvested at the optimum stage of ripeness.

Preservation of Seed Potatoes. Seed material from the main crop of potatoes on the Nilgiris develop several long sprouts and shrink very much in long storage. The development of long sprouts are disadvantageous as they use up a fair proportion of the reserve food. They also break easily while handling. "Fusares" a Bayer Product, brings about the inhibition of the sprouting when dusted over the seed tubers soon after harvest and the treated tubers remain firm and the sprouts are short. One pound of dust is sufficient to dust two hundred-weights of seed.

DDT and Benzone Hexachloride. Recent investigations have shown that it is possible to control most of the insect pests by a judicious use of either Benzone Hexachloride or DDT. DDT either as a 5 per cent dust or 0.1 per cent spray and that it is a specific for jassids on bendai, brinjal, cotton and paddy. The spray was found to have a salutary effect against the pests of cruciferous plant also. Yet another interesting finding about DDT is the control of Agathi weevil. This is a serious pest in Betelvine gardens against which we were till now practically helpless. Dusting with DDT 5 per cent was recently found to cause over 90 per cent mortality. The owners of betelvine gardens are so convinced of the beneficial effect of this treatment that they are now coming forward to have their entire infested gardens treated. The betelvine bug is another major pest of the garden. The same chemical was found capable of decimating this pest also. Bensone Hoxachloride has specific action against some other insect pests. The dust was found effective against striped bug of paddy.

Disease Position in the Province. A case of plant poisoning was investigated at Kollegal taluk of Coimbatore district. The village affected was Kamakarai about 10 miles from Kollegal situated on the border of the hills. It was reported that a batch of fifteen animals belonging to two owners died suddenly within half an hour after eating a wild variety of grass called "Kagayanagallu" in Canarese. The plant resembles elephant grass, growing upto 4½ to 5 feet in height. Animals exhibited shivering, salivation, giddiness, rolling of eyeball, dilatation of the pupil, tympany prostration, struggling and death. Since the symptoms were highly suggestive of Hydrogen cyanide, samples of grass were sent to the Government Analyst, Guindy and the Research Officer, Toxicology Section, Medical College, Madras both of whom confirmed the findings as positive for Hydrogen Cyanide".

Artificial Insemination. In May 1949 the number of animals inseminated was 85. Five calves born by Artificial Insemination were verified. In June 1949, the number inseminated was 45 and the number of calves verified was 5.

Research Notes

In the crop-weather data collected in 1948—49 in regard to the two varieties of cholam, viz. Co. 1 (Periamanjal) and Co. 3 (Talaivirichan), grown side by side, it appears that Co. 3, inspite of its tillering habits, has got the capacity to utilise the soil moisture in a more economical manner than Co. 1.

Fortnightly soil samples at three different depths in the portions of the same field occupied respectively by these two strains were taken for assessing, in duplicate, the moisture contents. The mean of the averages of the soil moisture data as percentage are presented hereunder—'depth-war',—with reference to each important growth phase of these two varieties of cholam :—

S. No.	Details of the growth phase	Depth at which the soil sample is taken: 3" Co.1	3" Co.3	6" Co.1	6" Co.3	12" Co.1	12" Co.3	Total rainfall in inches during the period	Acre yield in lb.: Co.1 Grain	Co.1 Straw	Co.3 Grain	Co.3 Straw
1.	Sowing to flowering (3—8—1948 to 15—11—1948).	6·35	6·96	9·63	10·74	12·40	14·25	2·75				
2.	Flowering to ear formation (16—11—1948 to 31—12—1948)	10·27	10·96	10·58	10·79	13·40	14·59	2·78	114	2544	124	2707
3.	Seed maturing stage (1–1–1949 to 25—1—1949)	4·04	4·53	6·90	6.47	10·85	9·64	Nil.				

If the water requirements of these two strains of cholam are similar, there should not be any difference between the moisture contents at everyone of these stages and that too in regard to each depth. In the first two phases of growth, Co. 1 seems to have consumed more soil moisture than Co. 3; but in the third phase of growth, Co. 3 looks like requiring more soil moisture, particularly from deeper

layers, than Co. 1, perhaps for meeting the needs of its physiological processes at the time of grain maturity. This is also explainable in one way, namely, the possibility of the variety Co. 3 having more ears than the number of plants due to its inherent habit of putting forth side shoots when once the survival of the main shoot becomes an uncertainty due to "Dead Hearts". The experiment is being continued with these two strains of cholam and further observations in regard to this aspect will be recorded.

The facilities given by the Central Farm authorities and the Millet Specialist for the conduct of the experiment and the Government Agricultural Chemist for the soil moisture estimations are gratefully acknowledged.

Agricultural Meteorology Section, Coimbatore 28th September, 1949. } C. BALASUBRAMANIAN.

TWO POTATO CROPS FROM ONE TUBER.

The temperate and equable climate of Nilgiris is suited to raise three crops of potatoes in one year namely irrigated, main and second crop. The usual method is to plant whole tubers. At the time of harvest these tubers which are known as mother tubers can be found as a shrunken mass of tissue. They are generally unfit for any further use and hence are usually thrown away. While harvesting the irrigated crop of 1949, a few mother tubers were found to be quite healthy, and well filled, unlike the usual shrivelled remanants. These were replanted during the main crop season of 1949 to find out whether they would yield again. It is surprising to note that these tubers not only gave another crop but gave also a fairly good yield. The yieds are given below :—

Variety	Mother Tuber No.	Yield in ozs.		
		Irrigated crop 1949	Main crop 1949	Total
Green Mountain ...	I	8	2	10
Golden Wonder ...	II	4	15	19
Golden Wonder ...	III	3	10	13

This shows that it is possible to raise two crops from one tuber, provided the tuber is healthy at the time of the harvest of the crop.

Agricultural Research Station Nanjanad, Ootacamund, P. O., Dated 6th September, 1949. } M. D. AZARIAH & R. S. ERNEST.

Crop and Trade Reports

Cotton Raw, in the Madras Presidency : The receipts of loose cotton at presses and spinning mills in the Madras Presidency from 1st February 1949 to 28—10—1949 amounted to 3,72,581 bales of 392 lb. lint. The receipt in the corresponding period of the preivous year were 3,37,443 bales. 4,88,253 bales mainly of pressed cotton were received at spinning mills and 5,426 bales were exported by sea while 92,623 bales were imported by sea mainly from Karachi and Bombay.

(Director of Agriculture).

Weather Review — For October 1949

RAINFALL DATA.

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
Orissa & Circars.	Gopalpore	20·5	+11·9	37·8
	Calingapatam‡	9·9	+2·0	33·4
	Vizagapatam	12·5	+4·7	38·8
	Anakapalle*	14·6	+6·2	47·3
	Samalkot*	12·7	+3·5	45·1
	Kakinada‡	3·9	—4·6	46·1
	Maruteru*	15·5	+6·6	48·3
	Masulipatam‡	3·1	—5·5	40·9
	Guntur*	5·5	+1·4	37·5
	Agrl. College, Bapatla*	6·8	—1·9	48·3
	Veeravanam* (College Farm)	10·4	(x)	48·6
Ceded Dists.	Kurnool‡	6·6	+3·4	41·2
	Nandyal*	3·2	+0·2	37·1
	Hagari*	4·3	+0·9	18·5
	Siruguppa*	7·7	+4·2§	30·3
	Bellary	4·5	+0·3	18·5
	Rentichintala	3·3	—1·7	28·7
	Cuddapah	2·5	—2·4	31·1
	Anantharajpet*	5·9	—1·5	40·1
Carnatic.	Nellore	1·1	—8·5	35·4
	Buchireddipalem*	3·0	—6·2	29·6
	Madras	3·5	—8·5	31·3
	Tirurkuppam*	1·9	—9·8$	44·1
	Palur*	3·5	—4·0	28·7
	Tindivanam*	3·1	—4·1	23·0
	Cuddalore	2·0	—9·5	25·0
Central.	Vellore	6·5	—0·3	39·0
	Gudiyatham*	8·2	+1·6	38·6
	Salem	6·9	+0·5	31·8
	Coimbatore (A. C. R. I.)*	5·4	—0·6	14·9
	Coimbatore (C. B. S.)*	4·9	—1·5	15·1
	Coimbatore	6·5	+0·2	17·5
	Tiruchirapalli	7·4	+1·1	35·7

Division	Station	Actual for month in inches	Departure from normal in inches	Total since January 1st in inches
South.	Negapatam	3·5	—7·1	18·7
	Aduturai*	2·9	—4·5	25·5
	Pattukottai*	5·2	—4·3	96·7
	Mathurai	1·2	—6·2	34.7
	Pamban	4·7	—3·8	15·8
	Koilpatti*	6·2	—0·4	19·2
	Palamcottah	2·1	—5·0	15·1
	Ambasamudram*	4·8	—1·5	12·8
West Coast.	Trivandrum	5·9	—4·8	52·9
	Fort Cochin	10·5	—2·9	134·9
	Kozhikode	8·3	—2·8	136·9
	Pattambi*	5·2	—4·3	96·7
	Taliparamba*	9·2	+1·0	164·2
	Nileshwar*	6·9	+0·8	169·5
	Pilicode*	4.2	—0·7$	160·0
	Mangalore	2·9	—4·4	159·5
	Kankanady*	3·9	—3·4	161·6
Mysore & Coorg.	Chitaldrug	4·3	—0·5	16·7
	Bangalore	10·3	+4·4	42·0
	Mysore	9·9	+4·0	28·3
	Mercara	6·4	—1·9	120·0
Hills.	Kodaikanal	9·4	—0·8	42·5
	Coonoor*	11·9	+1·6	34·9
	Ootacamund*	9·8	+2·0	40·1
	Nanjanad*	13·7	+7·1	47·4

Note:—

(1) * Meteorological Stations of the Madras Agricultural Department.

(2) Average of ten years data is taken as the normal.

(3) x Readings are recorded only from February 1948.

(4) $ Average of six years data for Tirurkuppam and seven years data for Pilicode is given as normal.

(5) § Taluk office normal is 4·0" and rainfall 7·2"

(6) ‡ Incomplete data since the particulars of the last few observations are not available.

Weather Review for October 1949

The month began with a fairly active monsoon along the West Coast. On 4—10—1949 the monsoon withdrew and continental air spread over the whole country, north of Lat. 14°N. Due to a depression noted in the East Central Bay of Bengal on 8—10—49, the activitity of the monsoon was revived to some extent, particularly in Tamil Nadu. Temperatures in the middle of the month were noted to be above normal in the region outside Kerala and South Kanara.

On 15—10—49 conditions became unsettled in the Andaman Sea. Next day they moved westwards into the South-East Bay of Bengal as a low pressure wave and four days hence the conditions in the South Andaman become unsettled. Three days afterwards the unsettled conditions in the Andaman Sea concentrated into a depression and resulted into a cyclonic storm moving in the West-North-Westerly direction.

The depression in the Bay of Bengal, noted on 26—10—49, intensified into a severe cyclonic storm. The severe cyclone in the Bay of Bengal was found to be centred at 0830 hourse I.S.T. on 27—10—49 about 100 miles South. South-East of Cocanada. The next day the cyclone struck the Circars Coast between Masulipatam and Cocanada and on that night became a feeble one. This cyclone caused locally very heavy rain along the Orissa Coast. The month ended with the continuous persistence of a well-marked discontinuity in the South-East Arabian Sea in the Laccadives and of Malabar Coast. The note-worthy falls in the month are given below :—

Date	Place	Rainfall in inches
8—10—1949	Pamban	2·0
9—10—1949	Alleppy	2·3
10—10—1949	Cochin	3·4
,,	Nagpur	2·2
15—10—1949	Vellore	2·0
17—10—1949	Salem	2·7
18—10—1949	Kurnool	2·3
22—10—1949	Tiruchirapalli	2·6
26—10—1949	Kozhikode	2·6
27—10—1949	Calingapattam	3·3
28—10—1949	Palakonda (Vizagapatam Dt.)	6·0

Monsoon Rainfall Summary June to September 1949

Season as a whole: " Though the monsoon arrived unusually early, it did not advance beyond the West Coast of the Peninsula during June and it got established in North-East India only at the end of the month. However, within the first ten days of July, it rapidly advanced over the whole country and remained fairly active giving well-distributed rain over most regions till the middle of August. There was a marked slackening in the activity of the monsoon over many regions during the second half of August. During the first fortnight of September, it was active to strong in most parts of Northern India and the central parts of the country while during the third week it was very vigorous in the South Circars, the Deccan and the Konkan. The monsoon withdrew from North-West India and the West United Provinces after the 19th September and from the rest of take country by the 3rd of October. Taking the period as a whole, the rainfall was normal or in excess over the country expect in Orissa and Madhya Bharat where it was deficient. Averaged over the plains of India, the rainfall for the season was 5 percent in excess. " [Extract from the supplement to the Indian Daily Weather Report, dated 18—10—1949]

Agricultural Meteorology Section, Coimbatore, Dated 11—10—1949.

M. B. V. N., C. B. M. & M. V. J.

Departmental Notiftcations — Postings and Transfers

GAZETTED SERVICE

Name of Officers	From	To
Sri Kachapeswara Iyer, S. S.	Asst. Marketing Officer, Madras.	Dy. D. A., Ellore.
,, Natarajan, T.		D. A. O., Chingleput.
,, Seshadri, A. R.		Asst. Entomologist, Coimbatore.
,, Sivaswami, E. G.	D. A. O., Chingleput,	Asst. Marketing Officer, Madras.

SUBORDINATE SERVICE

Achuthan Nambiar, K. — F. M. Wynad Colonization schme, Vaduvanchal to F. M. Nileswhar II; Chathukutty Nambiar, M. — Paddy Asst., to Paddy Asst Seed Development Schme, Tellichery; Gopalan, N. — Asst. in Oilseeds Tindivanam, to A. A. D. Badagara; Hanumantha Rao, M. — Asst. in cotton, Narasaraopet, to A. A. D. Ongole; Jaya Raj, M. V. — Asst. in cotton, Coimbatore to A. A. D. Nilakottai; Kanakaraj David, S. — Asst. Entomologist, Coimbatore to Asst. in Entomology, Coimbatore; Karuppannan, G. — Asst. in Millets, Coimbatore to A. A. D. Gobichettipalayam; Krishnamurthi, J. — Paddy Asst. Coimbatore, to A. A. D. Lalgudi; Krishnamurthi, K. — A. D. Vuyyuru, to A. D. Sugarcane Development Work, Chodavaram; Lakshmaiah, C. — Special A. D. Hospet, to A. A. D. Nandyal; Muthuswami, T. D. — on leave to Paddy Asst. Seed Devepment Work, Villupuram; Narayanan, N. — A. D. Pattukottai, to A. D. Thiruthuraipundi; Pattabhiraman, R.—A. D. Thiruthuraipundi, to A. D. Pattukottai; Purusothaman, G. — Asst. in cotton, Coimbatore, to A. D. Chidambaram; Ranga Reddi, B. — A. A. D. Nandayal, to A. A. D. Adoni; Ramakrishnan Nambiar, C. Asst. in Oilseeds, Tindivanam, to A. A. D. Ponnery; Ramachandran, K. — Asst. in cotton, Koilpatti, to A. A. D. Tellicheri; Ramadoss, A. — P. A. to D. A. O. Tanjore, to Asst. in Millet, Seed Development Work, Nilakottai; Rama Ratnam, F.M. Sugarcane, Liaison Farm, Kulitalai, to A.D. Cuddalore; Ramakrishnan, S.R. Asst. in Millets, Coimbatore, to A. A. D. Rasipuram; Subba Rao, A. — F.M.A.R.S. Sirugappa, to Asst. in Melon Scheme, Sidhout; Sanjeevi, P. S. — Asst. in Millets, Coimbatore, to A. D. Kulitalai; Viswanathan, M. A. — Cotton Asst., Coimbatore, to A. A. Peruntalmanna; Venkataraman, N. — Asst. in Millets, Coimbatore, to A. D. Ramnad.

APPOINTMENTS

Janab P. Ali, B. Sc., (Ag.) is appointed as upper subordinate and posted as Farm Manager, Wynad Colonization Scheme, Vattuvanchal.

The following I grade fieldmen shown in the annexure are appointed as upper subordinates and are posted to the vacancies shown against each :—

Arasappan, S. — A. A. D. Thirumangalam; Ananthanarayanan, K. R. — A. A. D. Gudiyattam; Devasirvatham, D. — Asst. in cotton Coimbatore; Kunhikannan Nambiar, K. — A. A. D. Calicut; Kadir Batcha, T. N. — Asst. in cotton, Coimbatore; Krishnamoorthi, S. —A.A.D. Mannargudi; Kaliyanasubramaniam, S. Asst. in Mycology, Coimbatore; Narayanan, V. — Asst. in Millets, Coimbatore; Ramachandran, S. — A. A. D. Ambasamudram; Ramakrishnan, S. R. — Asst. in Millets, Coimbatore; Rama Rao, C. V. — Asst. in Paddy, Coimbatore; Somappa Naidu, H. — A.A.D. Palakonda; Thangavelu, D. M— Asst. in millets, Coimbatore; Velmurugan, R. — Millet Asst Seed Development Schme, Coimbatore; Venkataswami, R. — Asst in Millets; Coimbatore; Yeganarayanan, S. — A.A.D. Sankarankoil.

Agriculture College and Research Institute, Coimbatore

LIST OF ADDITIONS TO LIBRARY FOR OCTOBER 1949.

1. AIYAPPAN (A): Report on the Socio-economic Conditions of the aboriginal tribes of the province of Madras. 1948.
2. BRICKLAND (J): Micorobiology and man. 2nd Edn. 1948.
3. BURCH (G.I.) & PENDELL (E): Human breeding and Survival; population, Roads to peace or war.
4. COHEN (R.L.) & GUIBLEBAND (C.W.): Economics of Agriculture. 1948.
5. DARLINGTON (C.D.) & MATHER (K.): The elements of genetics. 1949.
6. HERMI INIE (B.K.E.): Diagnostic techniques for Soils and Crops. 1948.
7. HUNTER (W.) & HUNTER (F.R.): College Zoology. 1949.
8. JOGI RAJU: Elementary lessons in agriculture in Telugu. 1949.
9. KNOWLES (F) & WATKIN (E): A practical Course in Agricultural Chemistry for senior students of Agricultural Dairying, Horticulture and Poultry husbandary. 2nd Edn. 1947.
10. KUBIENA (W.L.): Micropedology. 1938.
11. MARTIN (H): The Scientific principles of plant protection with Special reference to Chemical control. 3rd Edn. 1947.
12. MASEFIELD (C.B.): A handbook of Agriculture. 1949.
13. MATHER (M.): Biometrical genetics: their study of continuous. 1949.
14. STAPLEY (J.H.): Pests of farm Crops. 1949.
15. SNYDER (L.H.): The principles of heredity. 3rd Edn. 1946.
16. THOMPSON (La Verne Ruth): Introduction to micro-organisms 2nd Edn. 1949.
17. VAN HOOK (A): Sugar. Its production: Technology & uses. 1949.
18. WADDINGTON (C.H.): Organisers & genes. 1947.
19. WENT (F.W.) & KENNETH (V.): Phytohormones 4th print. 1948.
20. Annual Review of Biochemical and allied research in India, Vol. 18. 1947.
21. Department of Agriculture, Madras: Departmental Manual. 4th Edn. 1949.
22. Proceedings of the 7th meeting of the Animal Husbandry wing of the Board of Agriculture and Animal Husbandry in India. 6th—20th December 1948.

D. B. K.

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The Madras Agricultural Journal

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